

## CLAIMS

1. A method for manufacturing a minute structure, comprising:
  - a step of forming an ionizing radiation decomposing type positive type resist layer including a methyl isopropenyl ketone as a first positive type photosensitive material layer to be sensitized by an ionizing radiation of a first wavelength range;
  - a step of forming an ionizing radiation decomposing type positive type resist layer including a photosensitive material of a copolymer obtained by the copolymerization of an ester methacrylate and a methacrylic acid, with the weight average molecular weight of the copolymer of 50,000 to 300,000 and the ratio of the methacrylic acid included in the copolymer of 5 to 30% by weight as a second positive type photosensitive material layer to be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer;
  - a step of forming a desired pattern in the above-mentioned second positive type photosensitive material layer as the upper layer by decomposing reaction only in the desired area of the above-mentioned second positive type photosensitive material layer without decomposing reaction of the

above-mentioned first positive type photosensitive material layer by directing an ionizing radiation of the above-mentioned second wavelength range via a mask to the substrate surface with the first and 5 second positive type photosensitive material layers formed, and development using a developing solution, and then;

a step of forming a desired pattern in the above-mentioned first positive type photosensitive 10 material layer as the lower layer by decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive material layer by direction an ionizing radiation of the above-mentioned first wavelength range via a mask 15 to the substrate surface with the first and second positive type photosensitive material layers formed, and development, successively;

characterized in that a pattern of a convex shape is manufactured in the substrate by executing 20 the above-mentioned steps.

2. A method for manufacturing a minute structure, comprising:

a step of forming an ionizing radiation decomposing type positive type resist layer including 25 a methyl isopropenyl ketone as a first positive type photosensitive material layer to be sensitized by an ionizing radiation of a first wavelength range;

a step of forming an ionizing radiation decomposing type positive type resist layer including a photosensitive material of a copolymer obtained by the copolymerization of an ester methacrylate and a 5 methacrylic anhydride, with the weight average molecular weight of the copolymer of 10,000 to 100,000 and the ratio of the methacrylic anhydride included in the copolymer of 5 to 30% by weight as a second positive type photosensitive material layer to 10 be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer;

a step of forming a desired pattern in the above-mentioned second positive type photosensitive 15 material layer as the upper layer by decomposing reaction only in the desired area of the above-mentioned second positive type photosensitive material layer without decomposing reaction of the above-mentioned first positive type photosensitive 20 material layer by directing an ionizing radiation of the above-mentioned second wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development using a developing solution, 25 and then;

a step of forming a desired pattern in the above-mentioned first positive type photosensitive

material layer as the lower layer by decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive material layer by direction an ionizing radiation of 5 the above-mentioned first wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development, successively;

characterized in that a pattern of a convex 10 shape is manufactured in the substrate by executing the above-mentioned steps.

3. The method for manufacturing a minute structure according to claim 1 or 2, wherein the first positive type photosensitive material layer is 15 obtained by forming a first positive type photosensitive material layer by a solvent coating method, vaporizing the coating solvent in the layer by heating, coating a material for forming the second positive type photosensitive material layer, and 20 vaporizing the coating solvent by applying the heat to the formed coating layer.

4. A method for manufacturing a liquid discharge head comprising a step of forming a mold pattern with a removable resin in a liquid flow path 25 forming portion on a substrate with a liquid discharge energy generating element formed, applying and hardening a coating resin layer on the above-

mentioned substrate so as to coat the mold pattern, and dissolving and removing the above-mentioned mold pattern so as to form a liquid flow pat, characterized in that the above-mentioned step of  
5 forming a mold pattern comprises:

a step of forming an ionizing radiation decomposing type positive type resist layer including a methyl isopropenyl ketone as the first positive type photosensitive material layer to be sensitized  
10 by an ionizing radiation beam of the first wavelength range on the substrate;

a step of forming an ionizing radiation decomposing type positive type resist layer including a photosensitive material of a copolymer obtained by  
15 the copolymerization of an ester methacrylate and a methacrylic acid, with the weight average molecular weight of the copolymer of 50,000 to 300,000 and the ratio of the methacrylic acid included in the copolymer of 5 to 30% by weight as a second positive  
20 type photosensitive material layer to be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer;

a step of forming a desired pattern in the  
25 above-mentioned second positive type photosensitive material layer as the upper layer by decomposing reaction only in the desired area of the above-

mentioned second positive type photosensitive material layer without decomposing reaction of the above-mentioned first positive type photosensitive material layer by directing an ionizing radiation of 5 the above-mentioned second wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development using a developing solution; and

10 a step of forming a desired pattern in the above-mentioned first positive type photosensitive material layer as the lower layer by decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive 15 material layer by direction an ionizing radiation of the above-mentioned first wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development, successively.

20 5. A method for manufacturing a liquid discharge head comprising a step of forming a mold pattern with a removable resin in a liquid flow path forming portion on a substrate with a liquid discharge energy generating element formed, applying 25 and hardening a coating resin layer on the above-mentioned substrate so as to coat the mold pattern, and dissolving and removing the above-mentioned mold

pattern so as to form a liquid flow pat,  
characterized in that the above-mentioned step of  
forming a mold pattern comprises :

- a step of forming an ionizing radiation  
5 decomposing type positive type resist layer including  
a methyl isopropenyl ketone as the first positive  
type photosensitive material layer to be sensitized  
by an ionizing radiation beam of the first wavelength  
range on the substrate;
- 10 a step of forming an ionizing radiation  
decomposing type positive type resist layer including  
a photosensitive material of a copolymer obtained by  
the copolymerization of an ester methacrylate and a  
methacrylic anhydride, with the weight average  
15 molecular weight of the copolymer of 10, 000 to  
100,000 and the ratio of the methacrylic anhydride  
included in the copolymer of 5 to 30% by weight as a  
second positive type photosensitive material layer to  
be sensitized by an ionizing radiation of a second  
20 wavelength range on the first positive type  
photosensitive material layer;
- a step of forming a desired pattern in the  
above-mentioned second positive type photosensitive  
material layer as the upper layer by decomposing  
25 reaction only in the desired area of the above-  
mentioned second positive type photosensitive  
material layer without decomposing reaction of the

above-mentioned first positive type photosensitive material layer by directing an ionizing radiation of the above-mentioned second wavelength range via a mask to the substrate surface with the first and 5 second positive type photosensitive material layers formed, and development using a developing solution; and

a step of forming a desired pattern in the above-mentioned first positive type photosensitive 10 material layer as the lower layer by decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive material layer by direction an ionizing radiation of the above-mentioned first wavelength range via a mask 15 to the substrate surface with the first and second positive type photosensitive material layers formed, and development, successively.

6. A method for manufacturing a liquid discharge head comprising a step of forming a mold pattern with a removable resin in a liquid flow path forming portion on a substrate with a liquid discharge energy generating element formed, applying and hardening a coating resin layer on the above-mentioned substrate so as to coat the mold pattern, 25 and dissolving and removing the above-mentioned mold pattern so as to form a liquid flow pat, characterized in comprising at least:

a step of forming an ionizing radiation decomposing type positive type resist layer including a methyl isopropenyl ketone as the first positive type photosensitive material layer to be sensitized  
5 by an ionizing radiation beam of the first wavelength range on the substrate;

a step of forming an ionizing radiation decomposing type positive type resist layer including a photosensitive material of a copolymer obtained by  
10 the copolymerization of an ester methacrylate and a methacrylic acid, with the weight average molecular weight of the copolymer of 50,000 to 300,000 and the ratio of the methacrylic acid included in the copolymer of 5 to 30% by weight as a second positive  
15 type photosensitive material layer to be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer;

a step of forming a desired pattern in the  
20 above-mentioned second positive type photosensitive material layer as the upper layer by decomposing reaction only in the desired area of the above-mentioned second positive type photosensitive material layer without decomposing reaction of the  
25 above-mentioned first positive type photosensitive material layer by directing an ionizing radiation of the above-mentioned second wavelength range via a

mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development using a developing solution,

a step of forming a desired pattern in the

5 above-mentioned first positive type photosensitive material layer as the lower layer by decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive material layer by direction an ionizing radiation of  
10 the above-mentioned first wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development;

a step of forming a pattern including the

15 discharge port by applying a photosensitive coating resin film onto the first and second positive type photosensitive material layers with the above-mentioned desired pattern formed, exposing a pattern including a discharge opening communicating with the  
20 above-mentioned liquid flow path, and development;

a step of decomposing the resin components in the pattern comprising the above-mentioned first and second positive type photosensitive material layers by directing an ionizing radiation beam of a

25 wavelength range for the decomposing reaction of both the above-mentioned first and second positive type photosensitive material layers via the above-

mentioned photosensitive coating resin film; and  
a step of soaking the substrate after having  
the above-mentioned steps in a predetermined organic  
solvent for dissolving and removing the pattern  
5 comprising the above-mentioned first and second  
positive type photosensitive material layers .

7. A method for manufacturing a liquid  
discharge head comprising a step of forming a mold  
pattern with a removable resin in a liquid flow path  
10 forming portion on a substrate with a liquid  
discharge energy generating element formed, applying  
and hardening a coating resin layer on the above-  
mentioned substrate so as to coat the mold pattern,  
and dissolving and removing the above-mentioned mold  
15 pattern so as to form a liquid flow pat,  
characterized in comprising at least:

a step of forming an ionizing radiation  
decomposing type positive type resist layer including  
a methyl isopropenyl ketone as the first positive  
20 type photosensitive material layer to be sensitized  
by an ionizing radiation beam of the first wavelength  
range on the substrate;

a step of forming an ionizing radiation  
decomposing type positive type resist layer including  
25 a photosensitive material of a copolymer obtained by  
the copolymerization of an ester methacrylate and a  
methacrylic anhydride, with the weight average

molecular weight of the copolymer of 10,000 to 100,000 and the ratio of the methacrylic anhydride included in the copolymer of 5 to 30% by weight as a second positive type photosensitive material layer to 5 be sensitized by an ionizing radiation of a second wavelength range on the first positive type photosensitive material layer;

a step of forming a desired pattern in the above-mentioned second positive type photosensitive 10 material layer as the upper layer by decomposing reaction only in the desired area of the above-mentioned second positive type photosensitive material layer without decomposing reaction of the above-mentioned first positive type photosensitive 15 material layer by directing an ionizing radiation of the above-mentioned second wavelength range via a mask to the substrate surface with the first and second positive type photosensitive material layers formed, and development using a developing solution;

20 a step of forming a desired pattern in the above-mentioned first positive type photosensitive material layer as the lower layer by decomposing reaction of a predetermined area of at least the above-mentioned first positive type photosensitive 25 material layer by direction an ionizing radiation of the above-mentioned first wavelength range via a mask to the substrate surface with the first and second

positive type photosensitive material layers formed, and development;

a step of forming a pattern including the discharge port by applying a photosensitive coating resin film onto the first and second positive type photosensitive material layers with the above-mentioned desired pattern formed, exposing a pattern including a discharge opening communicating with the above-mentioned liquid flow path, and development;

10 a step of decomposing the resin components in the pattern comprising the above-mentioned first and second positive type photosensitive material layers by directing an ionizing radiation beam of a wavelength range for the decomposing reaction of both  
15 the above-mentioned first and second positive type photosensitive material layers via the above-mentioned photosensitive coating resin film; and

20 a step of soaking the substrate after having the above-mentioned steps in a predetermined organic solvent for dissolving and removing the pattern comprising the above-mentioned first and second positive type photosensitive material layers.

8 . The method for manufacturing a liquid discharge head according to any of claims 4 to 7,  
25 wherein the first positive type photosensitive material layer is obtained by forming a first positive type photosensitive material layer by a

solvent coating method, vaporizing the coating solvent in the layer by heating, coating a material for forming the second positive type photosensitive material layer, and vaporizing the coating solvent by 5 applying the heat to the formed coating layer.

9. The method for manufacturing a liquid discharge head according to any of claims 4 to 7, wherein the first wavelength range for sensitizing the first positive type photosensitive material layer 10 is a 270 nm to 350 nm range, and the second wavelength range for sensitizing the second positive type photosensitive material layer is a 230 nm to 260 nm range .

10. A liquid discharge head manufactured by the 15 method for manufacturing a liquid discharge head according to any of claims 4 to 9, wherein the height of the liquid flow path is provided relatively lower at a point adjacent to the bubble generating chamber on the liquid discharge energy generating element.

20 11. The liquid discharge head according to claim 10, wherein the cross-sectional shape of the bubble generating chamber on the liquid discharge energy generating element is a convex shape.